

## **MOBA: a New Arena for Game AI**

Author: Victor do Nascimento Silva and Luiz Chaimowicz

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The paper attempts to provide a comprehensive overview of AI agent application in MOBA (Multiplayer Online Battle Arena) games namely Dota, League of Legends, Heroes of Newerth, and many others. MOBA is a genre of online game where generally two teams consist of 5 player each are competing against each other by playing selected heroes/characters to defeat the opposing team in a 3-lane based map. The genre itself originated from RTS (Real Time Strategy) games in which instead of controlling 1 hero/character, each player is capable of using multiple units as their soldiers to defeat enemies.

The main difference between the two genres is the emphasis of micromanagement (player mechanics in controlling their hero) in MOBA instead of macromanagement (making decision in controlling units to create impact in larger scale) in RTS. That means, the focus of MOBA is that players with better ability to control their heroes are usually considered a pro/good player, even though the macromanagement part of MOBA is still important, for example player with better decision making in team battle (where one or more players facing one or more opposing players) is considered better than the ones not. There are only few researches of AI agent development in MOBA games, mostly since MOBA is identical to commercial e-sport and most of the games does not have accessible API to gather data. Aside from that, MOBA games have a lot of challenging aspects for AI agent to consider to be able to make good decisions.

A typical MOBA game has common phases that have distinct traits. Pick and ban phase is typically the first phase of MOBA game (especially in competitive plays) where players select their heroes. The challenge in this phase is usually how to select heroes as a team judging by their compatibility, roles and counter-pick the opponents (selecting hero that is better than the opposing). AI agent should be able to plan predict what strategy can be used, the strategy the opponent may use or effective heroes to select based on knowledge of enemies' heroes.

After pick and ban phase, the game starts and go to the opening phase where players buy starting items for their heroes and start going to their lanes or exploring the map. In the opening phase, agent's challenges are selecting starting items and allocating in which lane should they go. The laning phase will start as soon as the creeps advances to the middle of each lanes. In laning phase, opposing players are competing against each others to kill opposing creeps (to obtain resources), harass the opponents and avoid getting hit. In this phase, AI agent perform reasonings to decide on killing creeps, attacking opponents and most importantly positioning. Laning phase usually takes several minutes until each heroes are strong enough to fight against each other in team fights which is usually called mid game.

Mid game has quite a lot of diverse challenges for an AI agent. In this phase, most of the challenges in laning phase still exist with additional ones such as when to group with team members in team fights, when to push the lanes or when to kill other objectives to gain immediate advantages. Mid game usually will transition to late game after certain period of time where heroes are very powerful in which one mistake can translate to team's defeat. AI agent needs to perform prediction and analysis in real time in this last phase. Other than that, the authors also mention other challenges along with the specific challenges in each phase.

The proposed models in the paper is not divided by phases, instead it focuses on division by main tasks, which are item building model, laning model, team fighting model and theoretical

MOBA model. The proposed models for item building are planning, reinforcement learning and neural nets to be able to consider game and players' item state to plan the items to buy. Laning model should be able to simulate multiple agents to show the competition between agents in lane. The team fighting model should simulate interactions between agents in the game to determine moves and strategies. Lastly the theoretical MOBA model should simulate the game to predict and analyze situations and positions. The challenges overview and models of AI agent in MOBA games proposed by authors is aimed to "push the lane" into the direction of a better understanding and increased use of MOBA as research platform for AI agent.